Our Ref. No.: 002964.P004
Express Mail No.: EM020278592US

UNITED STATES LETTERS PATENT APPLICATION

FOR

SCALABLE ARCHITECTURE FOR TRANSMISSION OF MESSAGES OVER A NETWORK

Inventors: Anand Narasimhan
Yaacov Shemesh
Amit Kumar

Prepared by:

BLAKELY, SOKOLOFF TAYLOR & ZAFMAN LLP
12400 Wilshire Boulevard
Seventh Floor
Los Angeles, California 90025

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to the field of message receipt/transmission and delivery using computer, phone, wireless and other communications networks. Specifically, the present invention relates to the transmission of e-mail messages which may be text only, text plus an audio file, text plus a video file, text plus a fax file or any combination thereof to a phone, pager or fax machine or other receiving device suitable for the message content, over appropriate communications networks using an architecture which enables easy expansion to handle additional message traffic as well as to connect to additional communications networks, including networks which do not presently exist which may become available in the future.

Description of Related Art

Voice and data communications systems such as the public switched telephone network (PSTN) are currently used to transfer image and text data transmitted by facsimile ("fax") machines in addition to the normally carried voice traffic. These faxed images are usually transmitted through the PSTN and received for printout or storage of the image on a destination fax machine or computer for the use by the recipient.

In U.S. Application Serial No. 08/829,857 filed April 1, 1997 entitled Method and Apparatus for Transmission and Retrieval of Facsimile and Audio Messages Over a Circuit or Packet Switched

Network, it is disclosed that to provide for the receipt and transmission of audio and fax information by a first user over a circuit switched network such as the public switched telephone network (PSTN) to a second user over a packet switched network such as the Internet, a communications server is connected both to the circuit switched network and a packet switched network.

The communications server contains resources to receive and process incoming audio and facsimile calls from the circuit switched network into a format suitable for transmission over the packet switched network to the second user's address. In addition, a link is first determined between the second user's address on the circuit switched network and the second user's address on the packet switched network, and then an appropriate route to the second user's address on the packet network is determined. With the system being maintained in a distributed and redundant fashion, reliable receipt and transfer of all messages is ensured. A copy of the specification and drawings of U.S. Application Serial No. 08/829,857 is attached hereto as Appendix I.

However, the architecture utilized as described in U.S. Application Serial No. 08/829,857 is not easily scalable to handle increasingly higher levels of message traffic or to easily connect to networks in addition to the PSTN and the Internet. Figure 1 shows the essence of the architecture of U.S. Application Serial No. 08/829,857. An e-mail message is passed to an outbound resource 11 (communications server 150 in U.S. Application Serial

No. 08/829,857) which converts the e-mail message to a fax format or to audio for transmission to a fax machine or telephone connected to the PSTN. A database 13 stores customer information necessary for processing of messages (an unnumbered part of communications server 150 in U.S. Application Serial No. 08/829,857 which is also contained in database server 195 in U.S. Application Serial No. 08/829,857). After processing of an e-mail message by outbound resource 11, a fax or voice mail message is sent over the PSTN or more generally, a generalized switched telephone network (GSTN) which includes cellular telephone networks as well as the PSTN. Optionally, a pager message may also be sent informing a user of the fax which has been sent or availability of a voice mail message as described in U.S. Patent Application Serial No. 08/902,400 filed July 29, 1997 entitled Processing and Forwarding Messages From a Computer Network to a Forwarding Service.

SUMMARY OF THE INVENTION

A method and apparatus for accepting an incoming message over a packet network and transmitting it over a circuit switched network using a highly scalable architecture. The architecture utilizes a message queue and a router/filter within a private data network which is connected to an external data network such as the Internet, with separate outbound resource servers to provide the high degree of scalability, for handling a variety of message types.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a prior art architecture which performs the functions, but not the scalability of the architecture of the present invention.

Figure 2 is a block diagram illustrating the architecture of the present invention.

Figure 3 is a block diagram showing the data/control flow through message queue 21, router/filter 23 and database 27.

Figure 4 (4a and 4b) is a flow diagram of the processing performed by router/filter 23.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a method and apparatus for allowing the receipt and transmission of audio, video and fax information between a circuit switched network and a packet switched network. For purposes of explanation, specific embodiments are set forth to provide a thorough understanding of the present invention. However, it will be understood by one skilled in the art, that the invention may be practiced without these details. Further, although the present invention is described through the use of circuit switched and packet switched networks, most, if not all, aspects of the invention apply to all networks in general. Moreover, well-known elements, devices, process steps and the like are not set forth in detail in order to avoid obscuring the present invention.

Referring now to Figure 2, e-mail messages for a customer are sent to/through an external data network 15 (e.g., the Internet) and routed to an appropriate SMTP/HTTP (or SHTTP) server 17 as determined by a domain name server (DNS) 18 according to well known techniques. The e-mail message may be a text message or it may include a file, the content of which may be audio, video or bitmapped (e.g., a fax) or other data. Again, the techniques for creating and sending e-mail messages with these characteristics are well known.

A processing server 19, which includes a message queue 21 and a router/filter 23 first verifies that the message is from or is to a customer using information in database 27. After successful

verification, the message is broken into fragments (in the case of files with multiple attachments) and written to message queue 21. Router/filter 23 obtains messages from the message queue and handles least call routing/billing/ prioritization/filtering of messages. Filtering is primarily for notification messages for pager delivery. After billing verification and determination of a least cost route, the message is assigned to one or more outbound resources 31 for delivery to the intended recipient by a method or methods selected by the customer as previously recorded in database 27.

In the case of faxes, the outbound resource is a server which dials the destination fax number and sends the fax.

In the case of voice messages, the outbound resource is a server which dials the destination telephone number and plays the voice message.

In the case of notification messages, the outbound resource is a server which dials out to the paging terminal or delivers the notification message through any appropriate paging gateway.

After the message (in whatever form) has been delivered, a receipt with details and an error log (if any) is sent back via a secure protocol to the message queue 21.

The receipt/error log messages are then processed by the router/filter which interfaces with a billing system (not shown) for customer account update.

Figure 3 is a block diagram showing the data/control flow through message queue 21, router/filter 23 and database 27 using information contained in the following tables as explained with reference to Figures 4a and 4b.

MESSAGE_ID	This is a unique number assigned to each message that arrives in the system.
RESOURCE_ID	Unique number assigned to each Outbound Resource
RESOURCE_TYPE	Each Resource is identified by the type of messages it can deliver (e.g., FAX, VOICE, NOTIFY, etc.)
RESOURCE_ADDRESS	Location of the Resource (such as IP address)
MESSAGE_TO_EMAIL_ADDRESS	To: address of the message
MESSAGE_FROM_EMAIL_ADDRESS	From: address of the message
MESSAGE_LOCATION	Location of actual message on the Message Queue 21
MESSAGE_SIZE	Size of the message in bytes
MESSAGE_PRIORITY	Priority of the message (e.g., low, medium, high)
MESSAGE_CREATION_DATE	Timestamp identifying the date/time that the message was received by the system
MESSAGE_EXPIRY_DURATION	Amount of time after which the message becomes stale
MESSAGE_SCHEDULED_DATE	Scheduled delivery timestamp for the message
MESSAGE_STATUS	Current status of the message (Active, Pending, Sent, etc.)
MESSAGE_ESTIMATED_COST	Estimated cost for the delivery of the message
CUSTOMER_KEY	Unique number identifying the customer in the database
MESSAGE_PART_OF_BROADCAST	Flag identifying if the message is part of a larger broadcast list waiting to be delivered
BROADCAST_ID	Unique number identifying a broadcast list
COVERPAGE_ID	Unique number identifying a coverpage (if any) for a fax
MESSAGE_SUBJECT	Subject line of the message to be delivered
MESSAGE_DURATION	Duration of the message (delivery time of fax, or delivery time for a voice message, etc.)
MESSAGE_RATE	Rate for message delivery (dollars per second, etc.)
MESSAGE_SEND_DATE	Actual timestamp identifying when the message was delivered
MESSAGE_REMOTE_CSID	Identifier of the fax machine to which a FAX message was delivered
MESSAGE_TYPE	Type of message (e.g., FAX, VOICE, NOTIFICATION, etc.)
RESOURCE_COMMUNICATION_TYPE	Protocol used to communicate with the resource (HTTP, SHTTP, etc.)
MESSAGE_LANGUAGE_CODE	Language used for delivery of a receipt or response, based on settings in the customer table
MESSAGE_PAGES	Number of pages of a message (used primarily for a fax)

Table 1 Message Queue Table

FILETYPE_MESSAGE_TYPE	Identifier of a message type (FAX, VOICE, etc.)
FILETYPE_RESOURCE_TYPE	Identifier to determine a resource that can handle a particular file type
FILETYPE_EXTENSION	The filename extension that identifies a file type (e.g., WAV, TIF, JFX, AU, GSM, etc.)

Table 2 File Type Table

CUSTOMER_KEY	Unique number identifying a customer in the database
FIRSTNAME	First name of customer
LASTNAME	Last name of customer
COMPANY	Company name of customer
ADDRESSLINE1	Company address
ADDRESSLINE2	Company address
CITY	Company city
MAILREGION	Company state or equivalent
MAILCODE	Zipcode or equivalent
COUNTRY	Company country
WORKNUMBER	Customer work phone number
HOMENUMBER	Customer home phone number
EMAILADDRESS	Email address of customer
COLLECTIONMETHOD	Collection method such as Credit card, Debit, etc.
BILLTYPE	e.g., Customer, Demo, free, corporate, etc.
STATUS	Status of customer, Active, Inactive, etc.
LANGUAGECODE	Language of customer, English, German, etc.
CURRENCYCODE	Currency for billing the customer, US Dollars, Pound Sterling, etc.

Table 3-Customer Table

FORMAT	Currency label
CURRENCY_SYMBOL	Symbol for currency

Table 4-Currency Table

CUSTOMERKEY	Unique number identifying a customer in the database
PAGERTYPECODE	Code to determine the kind of pager service
BBSNUMBER	Modem number for pager notification delivery, based on the pager type
PAGERNUMBER	Identifier number of the pager unit
PIN	PIN code for the pager unit
DISPLAYTYPE	Display type of the pager (numeric, alphanumeric, etc.)

Table 5-Notification Table

RESPONSE_ID	Unique ID for a response/receipt message to be sent to a customer
REPONSE_SUBJECT	Subject line of the response message
RESPONSE_FROM_EMAIL	From: line of the response message
RESPONSE_BODY	Actual text of the response message

Table 6-Response_email Table

RESOURCE_ID	Unique identifier for the resource
RESOURCE_TYPE	Type of resource (FAX, VOICE, etc.)
RESOURCE_STATUS	Status of resource (Active, Inactive, etc.).
RESOURCE_QUEUE_STATUS	Status of the Queue, number of messages in queue
RESOURCE_TIME_ZONE	Time zone for the resource
RESOURCE_QUEUE_MAX	Maximum size of the resource queue
RESOURCE_ADDRESS	Address of the resource (IP address, etc.)
RESOURCE_NAME	Name of the resource
RESOURCE_EXPIRY_DURATION	Expiry duration for any message sent to the specified resource
RESOURCE_QUEUE_IN_STATUS	Number of messages waiting to be delivered by the resource
RESOURCE_COMMUNICATION_TYPE	Method used to communicate with resource (HTTP, SHTTP, etc.)

Table 7-Resource Table

RESOURCE_ID	Unique identifier for the resource
RESOURCE_PREFIX	Any digits to be dialed before an actual number
RESOURCE_CITY_NAME	Name of destination city for the message to be delivered
RESOURCE_PROVIDER_RATE	Rate for a particular city (dollars per second, etc.)
RESOURCE_MAX_DIGITS	Max number of digits allowed to be dialed
RESOURCE_AREA_CODE	Area code for the particular city

Table 8-Resource Rates Table

Figures 4a and **4b** are a flow diagram of the processing performed by router/filter 23 using Tables 1-8. When a message is received it is placed into message queue 21 which is simply a storage area, the specifics of which, including the mechanism for placing the message into the queue are well known. Certain details concerning the message are also stored in a message queue table (Table 1). In step 41, router/filter, which is a computer program running on processing server 19, polls the message queue table for pending requests as determined by the existence of an

active message in the message status field. If no message is found, after a system defined delay, the message queue table is again polled (step 43). Once a message has been found in the table, processing continues with step 45 by determining the message type using the message_type field in Table 1 and the file type information in Table 2. The customer is then validated using information in Table 3 in step 47. In step 49, currency information for the customer is obtained from Table 4. The message is then filtered for possible pager notification using the information in Table 5 in step 51. In step 53, Table 7 is used to check for available resources to deliver the message. In step 55, the rates of available resources are checked to determine the least cost resource using Table 8. Then in step 59, the message is delivered using the determined least cost resource. After the message has been delivered, or after an error in the delivery has occurred, in step 59, a response/receipt is composed using Table 6. In step 61, the response or receipt is delivered to the sender. The system then begins the process over again at step 41.

As noted above outbound resource 31 is equivalent to communications server 150 as described in U.S. Application Serial No. 08/829,857. The modifications made to outbound resource to enable it to operate in a system having an architecture as described herein are as follows.

These changes will be described with reference to the message structure of received messages.

Message structure

Each field has a value following an '=' sign and is terminated by a newline character. The exception to this is the "Message" field where a newline immediately follows the '=" sign and the actual message follows on the next line.

The fields of a message are as follows:

Password=

MessageID=

MessageStatus=

MessageSentTimeStamp=

MessageDuration=

MessageLength=

MessageRemoteCSID=

MessageSourceCSID=

MessageAttachStatus=

MessageDestination=

ResourceID=

ResourceStatus=

ResourceLastCommTimeStamp=

ResourceExpiryDuration=

ResourceQueueInStatus=

ResourceQueueOutStatus=

ResourceChannelMax=

ResourceChannelStatus=

MessageBoundary=

Message=

In the following explanation of the above fields, the text in brackets at the end indicates the entity providing the value for the field in the forward/reverse direction (i.e., from router/filter 23 (RF) to outbound resource 31 (RESOURCE), and from RESOURCE to RF, respectively). "NA" indicates that no value is applicable, and the text "NA" is used to populate the field. "Same" indicates that the same value is used in the reverse direction, i.e, the RESOURCE does not modify the value; it only echoes the value it receives in that field.

Password - There is a fixed password pair for each RESOURCE and RF combination. RESOURCE stores the RF password in a flat text password file in a directory (jfaxom), and RF stores the RESOURCE password in the database. (RF/RESOURCE).

MessageID - Unique ID, per message, generated by RESOURCE. (RESOURCE/Same).

MessageStatus - Code indicating current status of the message. See Status codes below. (RF/RESOURCE)

MessageSentTimeStamp - Time stamp indicating date/time the message was delivered to the final destination by RESOURCE. (NA/RESOURCE)

MessageDuration - Time (in seconds) to transmit message from RESOURCE. (NA/RESOURCE)

Messagelength - Number of pages transmitted by RESOURCE. (NA/RESOURCE)

MessageRemoteCSID - called subscriber identification (CSID) of fax machine to which message was transmitted. (NA/RESOURCE)

MessageSourceCSID - Source CSID. This may be customized per customer. (RF/Same)

MessageAttachStatus - Value of "A" indicates a message is attached for delivery. (RF/RESOURCE)

MessageDestination - Destination phone number. (RF/Same)

ResourceID - Unique ID, per resource, stored in the database. (RF/Same)

ResourceStatus - Code indicating the current status of the resource, i.e., whether it is active or not. RF uses this to determine whether further messages should be sent to RESOURCE for delivery. See Status codes below. (NA/RESOURCE)

ResourceLastCommTimeStamp - Date/time of last communication between RF and RESOURCE. (RF/RESOURCE)

ResourceExpiryDuration - Life of message (in minutes) on RESOURCE. If a message has not been delivered to the final destination by RESOURCE within this amount of time, the message is considered "expired" and is discarded.

ResourceQueueInStatus - Number of messages waiting to be processed in an Inbox directory on RESOURCE. (NA/RESOURCE)

ResourceQueueOutStatus - Number of messages waiting to be processed in an Outbox directory on RESOURCE. (NA/RESOURCE)

ResourceChannelMax - Number of channels available for use on RESOURCE. (NA/RESOURCE)

ResourceChannelStatus - Channel activity status, e.g., 0000000111000001, where 0's indicate an idle channel and 1's indicate a busy channel. (NA/RESOURCE)

MessageBoundary - Text for MIME boundary. (RF/NA)

Message - Actual MIME message sent by RF. If MessageAttachStatus=NA, no message follows this tag.

All fields are NA if not used.

Date fields are expressed in MMDDYYhhmmss format.

Resource Status Codes are:

A - Active

I - Inactive

Message Status Codes are:

P - Pending

H - On Hold

D - Deferred

R - Ready for sending to RESOURCE

X - Exchanged, i.e., sent to RESOURCE but not acknowledged by it.

A - Sent to RESOURCE and acknowledged by it.

S - Sent (i.e., receipt for final delivery received from RESOURCE)

Normal sequence for Message delivery by RESOURCE is:

RF receives a request in its queue (message queue 21).

RF sends the message to RESOURCE.

RESOURCE gets message, authenticates password, and creates a new message in the Inbox directory.

RESOURCE acknowledges receipt of message.

RESOURCE processes the message in Inbox (MessageStatus=A, MessageAttachStatus=A).

RESOURCE moves message to a Process directory for further processing.

RESOURCE finishes processing message and delivers it to final destination.

RESOURCE removes the message from the Process directory.

RESOURCE creates a message in Outbox directory. (MessageStatus=S).

If a "reply message" is to be delivered to the original sender, MessageAttachStatus=A, else MessageAttachStatus=NA. MessageID remains the same in either case.

RESOURCE delivers receipt (with "reply message," if applicable) to RF.

RF receives the message and puts it in the Queue for database processing.

Processing server 19 with the above described functionality may be implemented using readily available systems such as a Windows NT server or a UNIX server. Database 27 may be implemented as a database server using readily available systems such as a Windows NT server or a UNIX server running, for example a SQL database.

While the present invention has been particularly described with reference to the various figures, it should be understood that the figures are for illustration only and should not be taken as limiting the scope of the invention. Many changes and modifications may be made to the invention, by one having ordinary skill in the art, without departing from the spirit and scope of the invention.